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A method for forming arrays of metal, alloy, semiconductor or magnetic clusters is described. The method comprises placing a scaffold on a substrate, the scaffold comprising molecules selected from the group consisting of polynucleotides, polypeptides, and perhaps combinations thereof. Polypeptides capable of forming  $\alpha$  helices are currently preferred for forming scaffolds. Arrays are then formed by contacting the scaffold with plural, monodispersed ligand-stabilized clusters. Each cluster, prior to contacting the scaffold, includes plural exchangeable ligands bonded thereto. If the clusters are metal clusters, then the metal preferably is selected from the group consisting of Ag, Au, Pt, Pd and mixtures thereof. A currently preferred metal is gold, and a currently preferred metal cluster is Au<sub>55</sub> having a radius of from about 0.7 to about 1 nm. Compositions also are described, one use for which is in the formation of cluster arrays. One embodiment of the composition comprises plural monodispersed, ligand-stabilized clusters coupled to a polypeptide.